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PSYCHOLOGY AND SCIENTIFIC METHODS

## THE ATTACK ON DISTINCTIONS

TO discover differences and contrasts between things that resemble each other and to find points of similarity between dissimilar things are two kinds of mental activity which, although they appear opposite and contrary, are often found united. To employ them by turns is no less indispensable to progress in any kind of knowledge than are the two opposite movements of a piston to the rotation of the wheel which it sets in motion.

Their relative importance, however, varies in the different fields of research, and as there are sciences, or phases of scientific development, in which the first predominates, so there are others in which the tendency prevails to distinguish or establish oppositions and contrasts among facts instead of connections or analogies.

It may be asked into which of the two classes in particular do the speculations of philosophers fall?

If the scholastic precept "Distingue frequenter" seems to assign in these greater importance to the determination of differences, on the other hand the usual conception of philosophy as the search for the highest generalities, the universal, the absolute, etc., would seem to justify a diametrically opposite conclusion.

And of this latter conclusion it may be thought that we have further confirmation when, instead of attending to what philosophers have told us of their doings, we proceed to examine what they have actually done or are wont to do.

As a matter of fact, the form under which results of philosophical inquiries appear to us is not that of the recognition or determination of fresh distinctions and differences, but, on the contrary, that of the criticism or rejection of distinctions commonly admitted.

Before drawing from this fact a conclusion favorable to the conception of philosophy as an activity predominantly unifying and aiming at the suppression of every distinction and opposition, it will, however, be opportune to examine the different modes by which philosophers have proceeded in their struggles against distinctions

and differences. These various modes, as it seems to me, may be divided into the three following classes:

1. Those which consist in showing that there exists no precise line of demarcation between facts which are regarded as distinct, *i. e.*, in showing that the transition from one set to another is made by a series of intermediate gradations or shadings, in which the characters supposed to be distinctive are reconciled and the contrast between them disappears or becomes intangible.

2. Those which consist in showing that the properties in which the difference between the two classes of facts in question is supposed to consist, are possessed in equal degrees by both these classes, or by neither. As, for example, when the distinction between *egoism* and *altruism* is disputed by saying that even the so-called altruistic motives or aims are not effectual except in so far as those who are stimulated to action by them regard the result of the action as desirable and pleasing and regard its non-realization as a pain or want of satisfaction to themselves.

3. Those which consist in showing that the property, or properties, whose presence or absence is taken as a criterion of the distinction can be regarded, at the same time, as possessed and not possessed by any one of the objects in question according to the choice of the other objects with which we compare it. This is the case of the so-called *relative properties,* or *properties of relation.* So, for example, with numbers, the contrast between the words *preceding* and *succeeding* does not correspond to any distinction among them inasmuch as the fact that a number follows another does not prevent its preceding in its turn the one that follows itself.

Now, as to the processes of the first class, it is evident that the distinctions which they aim at destroying vanish only to reappear under another form, or even to return—like the demon, in the Gospel story, cast out of the man possessed—accompanied by other distinctions more powerful, and able to resist every further effort of dissolving analysis.

For instance, in answer to one who thought that the antithesis between "unity" and "plurality" could be destroyed by saying that from the *one* transition may be made to the *many* by successive additions, it might be observed that this is equivalent to a recognition that there are so many classes of *plurality, i. e.,* that, besides the distinction between the *one* and the *many,* there are others between the different *manys,* and that, therefore, by attempting to destroy the distinction in question he at once brings a hornet's nest about his ears, like the monkey in the fable who, being angry with his image reflected in a mirror, broke it in pieces and only

succeeded in multiplying the figure which he had expected to annihilate.

Nor is it to be believed that more success attends attempts of the second class, those by means of which the value of a distinction is disputed by showing that some of the characteristics which were supposed to differentiate the two classes established by them are common to both.

A typical example on this point is offered us by the criticism of the distinction between the mere succession of two facts and what is expressed by saying that one of them has *produced,* or has been the *cause* of, the other. The result of such criticism has been to make it more apparent what are the distinctive characteristics whose possession confers, on the successions to which the names of "cause" and "effect" are applied, such superior importance in comparison with all the other classes of successions that experience presents to us.

"To say that a given fact is 'produced' by another," observe the critics of the idea of cause, "means nothing more than this: that the first has been succeeded by the second and that we have reason to believe something similar to the second will happen every time that anything happens similar to the first: and that something similar to the first has happened whenever anything happens similar to the second."

But surely this does not imply that all successions are of the same theoretical and practical importance. It is rather an acknowledgment that, among them, are some whose investigation contributes, in a particular way, to widen the field of our previsions and actions, and which, just on that account, deserve to be kept distinct from all others—whatever, on the other hand, may be the name that is adopted for this purpose.

The case of distinctions to which only greater prominence is given by every effort directed to the obliteration of the line of demarcation established by them is not the only one to be considered among those of the second class, mentioned above. Another case, no less important, is that of distinctions in regard to which such efforts, although they do not succeed in destroying, nevertheless succeed in *shifting,* the aforesaid line of demarcation, carrying it on to intersect one or other of the two classes which it at first separated.

Such shifting, however, is not followed by the complete disappearance of the original line of separation, but in most cases only by a diminution of its importance in comparison with the new one which is introduced.

If the latter absorbs and attracts to itself some of the offices of

the first one, this may, nevertheless, still keep some others of them, and eventually acquire new ones which it did not possess at first. It not seldom happens that a distinction, by such successive transplantings and shiftings, gives rise to a series of subordinate distinctions or "segmentations."

The position which is finally assumed by the original line of demarcation corresponds ordinarily to a distinction of greater importance than those corresponding to the successive positions abandoned by it. Sometimes, however, the distinction in question, after having served to produce a series of others, more or less important, is finally reduced to cutting, so to speak, in the void, like a blade which has under it none of the material which it is intended to cut.

Of all the various changes that ordinarily accompany what we may call the *shifting of distinctions,* we have an example in the history of the distinction between *appearance* (phenomenon) and *reality* (essence, noumenon).

The very word "phenomenon," from its use as a technical term in Greek astronomy denoting the contrast between the "apparent" motions of the sun and the stars in the celestial sphere and their real motions in space, seems to have been very soon transferred by philosophers (Democritus) to denote, by analogy, the contrast between the properties of bodies which "appear" to our senses (colors, flavors, etc.) and their *real* structure, consisting of the respective positions and motions of the indivisible particles (atoms) of which they were supposed to be made up.

The word thus assumed the fresh office of distinguishing the properties which in later times were called the *secondary* properties of bodies from the so-called *primary* properties (such as form, resistance, weight, etc.). But even here a new shifting could not be long in taking place. Philosophers did not fail to ask themselves what reasons there were for conferring any privilege on these last properties on account of their being perceived "by means" of our touch or muscular contractions instead of "by means" of our eyes or our palate. To believe that a thing which we *feel extended* is *really extended,* observed they, is as unreasonable as to believe that a thing which we *see* red or green is "really" so, in itself, independently of our visual organs.

To find a new employment for the distinction, which thus became useless, two ways were open. It was possible, in conformity with the common use of the words, to employ it in the humble office of distinguishing the impressions of the man awake, with his senses in their normal condition, from those of one under hallucination. That would have led philosophers to a clearer recognition of the

properties by which the former are distinguished from the latter (coherency, their being common to more than one person, their ability to be foreseen, etc.). Unfortunately, other prepossessions (especially sentimental ones) spurred on philosophical speculation in a diametrically opposite direction. From the admission that all properties, known or knowable, of bodies were alike "apparent," the conclusion was inevitably drawn that to ask whether bodies do really exist, would be to raise a question beyond the limits of the capacity of the human mind—a question to be classed among the insoluble "enigmas" of the universe. With this last evolution, the word "phenomenon" finally came to denote anything of which one might speak, knowing what he is talking about, and its contrary (noumenon, thing in itself) to denote nothing but our desire to have at our disposal a word that has no meaning.

It remains for us to consider the third of the three methods employed by philosophers in the criticisms of distinctions. It consists in claiming for a distinction concerning comparisons or relations between different objects a sense independent of the consideration of such comparisons and relations, and in regarding the fruitlessness of the attempts directed to such an aim as a proof of the unreality and invalidity of the distinction in question.

An example will explain better how this comes about. It is difficult to find, in the whole field of logic, a distinction which is so radical and important as that between affirmation and negation. And this is so, notwithstanding the fact that to ask oneself whether a given proposition is affirmative or negative, has as little sense as to ask oneself whether an object is larger or smaller without stating with what other object one wishes to compare it. There is, in fact, no affirmation that can not be regarded as the negation of some other affirmation, and if we disregard grammatical niceties, it is just as exact to say that every affirmation is a negation as to say that every negation is an affirmation. But shall we then have to say that there is no difference between affirming *anything* and denying *it*? The true distinction, therefore, is not between propositions of one class and propositions of another, but between *every* proposition and the *corresponding* negation, in the same way as the words "east" and "west" do not express any quality of the regions to which they are applied, but only indicate that these regions are in a given situation with regard to each other.

The illusions occasioned by the above-mentioned tendency to interpret a sentence which expresses a relation between different objects as if it must have a meaning for each of them taken separately, has some affinity with those exemplified by that class of

sophisms which scholastic logic describes as taking what is said *secundum quid* as if it were said *simpliciter, i. e.,* the sophisms consisting in passing from an affirmation which is only true under certain restrictions, or in relation to given circumstances, to another in which such restrictions are lost sight of.

The only difference between the one case and the other is this, that, in our case, the conclusions arrived at can not even be false, inasmuch as the sentences which enunciate them have no meaning at all, as if one were to say, for instance, that two quantities were proportional without saying to what other two, or that a straight line was perpendicular without saying to what straight line or superficies.

Among the most characteristic and instructive cases of this class must certainly be placed those furnished by the recent discussions on the axioms of mechanics, especially on the meaning of the law of inertia.

The usual way of enunciating this law is liable to the objection that to assert that a body is moving in a straight line and with uniform motion can have no meaning, unless we determine:

1. To what body, supposed to be fixed, the successive positions of the body declared to move in a straight line are to be referred. A straight line drawn on a sheet of paper, while it is moving, does not imply a rectilinear motion of the point with which it is drawn; and, *vice versa,* given any motion of a point, the possibility is never excluded of so moving a sheet of paper in relation to it as to obtain a straight line upon the paper.

2. What is the measure that we adopt for *time;* in other words, by what standard are two successive intervals of time to be judged as equal or unequal. For instance, according as we choose for that purpose the apparent motion of the sun or that of the fixed stars, the same motion will appear uniform or not uniform; and no appeal can be made here, as in the case of two persons whose clocks do not agree, to any common criterion, since it is just on the choice of the criterion that the dispute turns, *i. e.,* the choice of the "standard" motion by which all others shall be measured. To say that the motion adopted as "standard" is uniform, without saying *with regard to what other motion* (just as, in the case of points of reference, to say that a body is stationary without saying in regard *to what other bodies*), is as unreasonable as to say that a man is a "contemporary" without saying of what other person.

Attempts have not been lacking to draw—from the admission of the dependence of the law of inertia on the choice of points of reference and of a fixed measure of time—the conclusion that such a law

is only the result of a convention and does not correspond to any real fact, as if the very *possibility* of choosing points of reference and measures of time, in regard to which the law of inertia subsists, were not itself a fact: a fact of which we only take advantage in order to construct our science of mechanics, in the same way as we take advantage of the weight of lead to make a plumb-line, or of the instability of certain chemical compounds to make lucifer matches. If the world in which we live did not furnish us with this *fact*, no choice of conventions could combine to create it, or even to conceal its absence. The only difference between it and the more ordinary facts of our experience consists in its complexity, which is due to its implying the consideration, not only of the motion of a body with regard to another body, but also the comparison of one motion with another motion.

Distinctions based on properties that can at the same time be said to be possessed or not possessed by a given object, according to the other objects with which it is compared, are so far from being less important than others that they even form the principal object of scientific research, and tend ordinarily to acquire more prominence and importance in a science in proportion to the growth of that science in precision and power.

To prove this, we need only observe the prominent place that distinctions of this kind occupy in the sciences to which mathematical methods can be applied. To the example from mechanics, mentioned above, many others might be added no less instructive, from the distinction implied by the idea of "mass" to the more complex distinctions which come into play in other branches of physics and presuppose the choice of even more artificial points of reference and of many units of measure. The special feature of such distinctions is that the words which express them can only be defined indirectly, *i. e.*, by stating the meaning of a whole sentence in which they appear, as is the case, for instance, with the word "ratio" (λόγος) as used by Euclid, which he only defines by explaining the meaning of the assertion that the two quantities "have the same ratio to each other" as two others.

After having thus passed in review the various methods employed by philosophers for the criticism of distinctions, and having stated how each of them leads to a result diametrically opposite to the one at which it aimed, *i. e.*, leads to the increase rather than the decrease in the number and importance of the distinctions concerned, it will perhaps not be useless to consider some of the consequences which would result from the more deliberate and systematic applica-

tions of such methods to some of the most frequently discussed questions of contemporary philosophy.

Let us take, as an example, the controversy between determinists and their opponents.

Taking as a point of departure what has been said before about the idea of *cause*, and keeping in mind a principle that both contending parties agree in admitting, viz., that, properly speaking, there are no facts that *repeat* themselves (in spite of appearances due to our disposition to notice only differences interesting to us), but only facts which have more or less resemblance to one another, the conclusion is inevitable that when we say the *same* causes are always followed by the *same* effects, what we mean is, in substance, this: that *effects* which *resemble* one another constantly succeed *causes* which *resemble* one another.

What is called the "principle of causality," in so far as it asserts nothing but the existence of certain resemblances among facts whose antecedents resemble one another, is, therefore, no more incompatible with a certain degree of indeterminateness in the "effects" of given "causes" than, for example, the laws of biological heredity are incompatible with the occurrence of *spontaneous* individual divergences and variations among the descendants of the same progenitors.

To say that the effect of a given cause is determined, can only mean that *some* of its characteristics are determined, in other words, that a class, more or less extensive, is determined, to which it must belong. Therefore, the only difference there can be between determinists and their opponents consists in regarding as possible a greater or less divergence and dissimilarity in the effects of causes having given degrees of similarity, *i. e.*, in a different estimate of the greater or less probability, or frequency, of such divergences in the various fields of scientific research, from physics and mechanics to psychology and the social sciences.

Determinism and indeterminism thus come to appear as the two extreme terms of a series of possible intermediate alternatives in which the alleged opposite characters of the two theories figure, mixed and combined in the most varied proportions.

To the above example of the application of the first of the methods, already mentioned, I will add another of the application of the second and the third. The criticism to which the idea of *quantity* has been recently subjected in the more abstract regions of mathematics has led, among other things, to a clearer recognition of the nature of the distinction between what are called "differences of degree" or "quantity" and other differences, which, in contradistinction to them, we call "differences of quality."

The conclusions arrived at on the subject may be briefly summed up as follows: Differences in *quantity* are only a *special case* of differences in *quality*. They are distinguished from the latter above all by the fact that the qualities, on which they are grounded, allow a fixed arrangement of the objects possessing them, that is, they can serve as criteria to distinguish, between any two of them, which precedes or follows the other in a certain fixed series of which they all form parts. Thus, for example, the resistance which different threads make to breaking gives rise to quantitative differences among them, inasmuch as of any two of them it can always be determined which will be broken more easily than the other. On the other hand, their differences, for example, of color (unless these concern only different gradations of the same color), can not be described as *quantitative* differences, because they are incapable of being employed as criteria for an arrangement in which a certain place belongs to each of the threads.

But if the aforesaid condition is indispensable in order that given differences may be described as *quantitative* differences, it is nevertheless insufficient to define completely the notion of quantity. For this we require the presence of further conditions, more directly connected with that special method of comparison which is denoted by the name of *mensuration*.

In other words, it is required that on the objects possessing the qualities in question some operation may be performed whose analogy to that of the arithmetical sum is sufficient to allow a precise meaning to be given to the phrase that one of them possesses the said quality in a degree double, triple, etc., that in which another possesses it.

Here also we have another example of the fact, already observed, that the methods employed by philosophers for the criticism of distinctions often result in the discovery of some new way of determining and justifying the distinctions which they aimed at destroying.

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## DISCUSSION

### LOGIC AND EDUCATIONAL THEORY

IN his courteous review of "A Primer of General Method," in No. 21 of the current volume of this JOURNAL, Professor Hibben states that any attempt to discuss logical theory from the pragmatic standpoint is almost sure to reveal certain structural weaknesses

peculiar to that way of thinking, and points out several places in the text where, as he believes, defects are plainly visible.

1. For example, no pragmatist warrant can be shown to account for the systematic necessity of judgment. "The element in the feeling of compulsion which expresses logical necessity is free of all pragmatic sanction."

Upon this point it seems sufficient to say that the logical necessity which belongs to any given judgment is a particular and concrete necessity. The ground of *A*'s judgment is influenced by *A*'s interests and purpose. *B*'s different interests and purposes may lead him to form a different judgment. The logical necessity is just as truly operative in the one case as in the other. It is hardly correct, then, to say that logical necessity " swings clear of all pragmatic variability," unless you have in mind some vague, shadowy, abstract "necessity-in-general" that dwells apart from the concrete particulars of our purposive daily life.

2. Again, Professor Hibben regards as a mere assumption the idea that hypotheses are formed always with a view to action. To connect any one of the famous hypotheses of science, the nebular hypothesis, the theory of gravitation, the Copernican theory, the theory of evolution or the theory regarding the ebb and flow of the tides, with the practical needs of man "would be a most unnatural and strained procedure." By way of refuting the statement that hypotheses are started under the spur of practical interest he chooses the Copernican theory as an example, and remarks that "the view that the earth is stationary and that the sun actually rises and sets is a far more useful, convenient, and practical idea than the Copernican theory. For the practical man it stands the pragmatic test most adequately."

Precisely. But why does not the astronomer retain it? Why does he seek and find another one? Professor Hibben answers: "For the astronomer it does not work. Let him satisfy himself with a different theory."

No answer could be more satisfactory to the pragmatist. Our personal, practical interests and purposes lead us to think and speak of the sun as rising and setting, and of the earth as stationary. The astronomer employs the other theory because practical convenience decides in its favor. To quote a writer,[1] who it is but fair to admit is open to the suspicion of pragmatist tendencies, it was "not because of any sheer failure to represent celestial motions, but the growing cumbrousness of the assumptions, and the growing difficulties of the calculations."

3. A third "structural weakness" is discovered in the statement

[1] Schiller, "Humanism," p. 59.

that "advancement in intelligence means organization into a systematic whole of each bit of knowledge that we possess." This statement, it would seem, necessarily involves the acceptance of the extraordinary theory that we shape our conduct from moment to moment "by our knowledge of the ends which the complex nature of the whole implies."

It is, however, one thing, surely, to speak of the way in which our knowledge grows, of the tendency towards an ideal system, and a slightly different thing to claim to have solved the riddle of the universe; for the latter is what is practically involved in having "before us as a conscious methodological procedure the practical ends involved in the systematic whole." The pragmatist is the last man in the world to deal with things in that wholesale fashion. He is satisfied if he can solve one small problem at a time. If one were asked for a pragmatic account of the process of organization of our knowledge into a systematic whole, one could not do better than take Professor Hibben's statement. "We follow," he says, "the lead not of far-off and concealed ends, but rather of the nature of the separate parts as they are in themselves and as related to each other." Each step forward, in the solution of the practical problems daily confronting us, brings with it a larger view of the world and its meaning, a more comprehensive organization of our knowledge. Reflection upon this growth of knowledge from the relatively unorganized, the rather fragmentary systems of childhood to the more comprehensive systems of later life warrants us in speaking of a tendency towards an ideally constructed system.

4. Professor Hibben states that the disjunctive judgment, since it expresses the nature of a system not in its relation to anything else but as a self-related whole with an individuality of its own, "is certainly one logical form at least which is not concerned with the adjustment of means to ends, and of practical values, but exhibits that which is an end in itself."

If, by "a self-related whole with an individuality of its own," we mean to denote a kind of system which in its nature wholly excludes the element of human purpose, there is probably nothing more to be said. But if, on the other hand, the element of purpose enters into every idea we possess, that element may legitimately be considered, must be considered, when we attempt to exhibit the whole nature of a system in disjunctive form. The purpose is immanent, not external. We may thus set forth the essential features of the system; and by doing so we are enabled to identify our problem, and decide upon our course of action. If it is a game of curling, and after consideration you decide that to win you must either draw around the guard or raise your last stone on to the winner,

you are then in a position to say which alternative you will choose. Subtract from any system the purposive element, and the remainder would be hardly worth considering.

5. So much for the logical side of the matter. On pragmatist principles knowledge is for action, and in this instance it was an interest in the practical problems of education that led into the field of logic. The important thing is the application of the doctrine to the theory of education, and here Professor Hibben has offered a few criticisms upon which some comment may be made.

There is, first, the complaint that confusion has arisen between the idea of "being interested in what one is studying," and that of "being interested in the practical utility which the subject-matter may possess." Then there is expressed the fear of a certain "dwarfing" that will inevitably follow both of intellectual power and of character if during the formative period of life the child lives in an atmosphere in which utility is regarded as the sole motive for the acquisition of knowledge. Finally there is a plea for "those indirect uses of knowledge," which are somehow "too subtle, too far-off in their effects, too complex, too cumulative for any one to detect, and name, and tabulate," but which, nevertheless, "characterize richly stored minds."

There is no need whatever for any confusion between interest in what one is studying and interest in its practical utility. It is, indeed, not only possible, but also essential, that the rich materials to be found in certain subjects should make their appeal to the student. The esthetic needs of the learner demand an acquaintance with literature and other forms of fine art. History in certain of its phases effectively meets those needs, while in other aspects it possesses a practical value. In all forms of practical activity in which students engage while carrying out their plans and purposes, there is a continual appeal to the artistic side of their natures as well as to the practical and utilitarian.

It is the business of the teacher to base his practise upon some theory of education. The more clearly he realizes the aim of education the better for his school. But it is no part of his duty to indoctrinate his pupils with educational theory. Most teachers recognize that anxious reflection by a child upon his moral and intellectual progress is not what is required, but, rather, active and interested participation in the business of life. As a matter of fact the opponents of the doctrine of interest are the chief offenders at this point. It is they who are guilty of the sin of preaching up the ultimate utility of this, that, or the other art, or study as an incentive, in a usually hopeless attempt to get their pupils to study something at present outside of the range of their interests.

The phrase, a richly stored mind, is capable of more than one interpretation. It may mean a mind stored with ideas which have been acquired for specific purposes, the achievement of a definite end, the accomplishment of this task, the solution of that practical problem; the mind of an active, inquiring, alert individual whose program of work and play has been determined by his personal needs, practical, esthetic, moral, spiritual, in the actual historical order of their development. Or it may mean a mind stored with ideas which in the order of their acquisition bore no direct relation to the learner's needs, but were carefully chosen for him by some outside authority with a view to possible future needs; the passively obedient, acquiescent, docile mind with the traditional stock of knowledge furnished by the schools, bearing the stamp of their approval, and therefore possessing that "fine flavor" of which Professor Hibben speaks with such enthusiasm.

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## REVIEWS AND ABSTRACTS OF LITERATURE

*Psychology: General Introduction.* CHARLES HUBBARD JUDD. New York: Charles Scribner's Sons. 1907. Pp. vii + 389.

*Laboratory Manual of Psychology.* CHARLES HUBBARD JUDD. New York: Charles Scribner's Sons. 1907. Pp. x + 127.

These are the titles of the first two volumes of a series of three books "designed to introduce the student to the methods and principles of scientific psychology." The third volume will be devoted to a description of apparatus and the general equipment of the laboratory.

The very comprehensive aim of the "General Introduction" is stated in the preface as follows: "(1) to develop a functional view of life, . . . (2) to adopt a genetic mode of treatment, . . . (3) to give to the physiological conditions of mental life a more conspicuous place than has been given by recent writers of general text-books on psychology, . . . (4) to make as clear as possible the significance of ideation as a unique and final stage of evolution. The clear comprehension of the dominant importance of ideational processes in man's life is at once the chief outcome of our study, and the complete justification for the science of psychology. . . . This work is intended to develop a point of view which shall include all that is given in the biological doctrine; while at the same time it passes beyond the biological doctrine to a more elaborate principle of indirect ideational adaptation."

Almost one third of the volume is devoted to the nervous system and sensation. Chapter II. is an admirable presentation of the evolution of the nervous system. Beginning with the results of Jennings's study of unicellular organisms, the author traces the differentiation of primitive

functions through the ascending scale. The progressive development of higher centers is the fact of chief significance. These permit the organization of activities, and they provide for greater complexity and unity of behavior. The evolution of higher centers culminates in the association centers (*Flechsig*) in man. These association centers are less predetermined by heredity than are the lower centers. They are, therefore, molded largely by individual experience. They are the instrument of the more delicate and comprehensive "indirect adaptations" of the individual. These association centers as the organs of ideation thus constitute the essentially human higher story added to the vertebrate nervous system.

The chapter on the "Human Nervous System" is well conceived, compact, and effectively illustrated. Two exceptions to the general clearness of statement deserve passing mention. The victim of the "famous crowbar" accident is by implication credited with no change in his mentality as a result of the accident. It is, of course, well known that a profound alteration in disposition and personality actually occurred. Again, the sharp distinction drawn between sensory and motor areas of the cerebral cortex is misleading to the young student. No suggestion follows to emphasize the essential identity of location of these areas.

In pursuit of functional and genetic aims, the author finds it useful to substitute for the tripartite division of mind the following five classes of phenomena: (1) Sensation factors, (2) relations between sensations (perceptual fusions), (3) attitudes (corresponding to feeling, interest, attention), (4) memory contributions to experience (including memory images of sensations and sensory relations and attitudes), (5) ideational relations. These constitute the characteristic forms of human consciousness, and include such facts as experiences of language and forms of scientific thought.

The functional and genetic trend is still further indicated by such chapter headings as (VI.) "Sensations and their Functional Relations," (VII.) "Experience and Expression," (VIII.) "Instinct and Habit."

Furthermore, we are not allowed to forget that the central and unique concept of psychology is that of the self. The essential function of the nervous system is organization of experience. The processes of consciousness are mainly those of association and integration. "All forms of consciousness are types of organization." Psychic complexes are continually undergoing transformation and translation to higher levels. The whole treatment from this point of view might be called a revised edition of apperceptionism carried out in a thoroughgoing manner.

With such a background, the contrast phenomena of forms of dissociation loom most vividly in Chapter XIV. Here come illusions, hallucinations, sleep and dreams, fatigue, effects of narcotics, alcohol, auto-intoxications, hypnosis, dual personality, and insanity. This is decidedly one of the most important chapters of the book.

While maintaining for the most part the strict attitude of natural science, the author has not hesitated to introduce, wherever necessary, philosophical discussions. The attempt to reconcile the personality cate-

gory with rigid determinism may leave some readers a bit mystified and unconvinced. For this reason, perhaps, the chapter on the self is the least successful.

When one recalls the multiple and difficult aims of the work, the result constitutes a notable achievement. Many will vote it the most comprehensive introductory text that has recently appeared.

The full treatment of the nervous system, the careful consideration of dissociation phenomena, the suggestive chapter on language, the discussion of imagination and concepts containing illuminating paragraphs on the uncritical, the literary, and the scientific forms of imagination, the genetic psychology of concepts, the psychology of logical processes, and no less the final chapter on the applications of psychology, wide in scope, rich in learning, and intensely practical,—all these produce an impression of fullness and adequacy to be desired in a general introduction.

The style is pedestrian, simple, and generally clear. The illustrations, while not extensive in range, are taken from ordinary experience, and are employed most effectively. Marginal paragraph headings give the page a somewhat dense and heavy appearance distinctly less inviting to the beginner than the more open formation produced by bold-faced headings in the body of the text.

Opinions will inevitably differ as to the best order of topics in an introductory book. But it is questionable whether a psychology which abominates psychic atoms and emphasizes personality should adopt the synthetic order. Thus the student is led through the mazes of neurology and sensation and percepton of space and time, for many weeks, before there is any quickening contact with the complex phases of his consciousness with which he has most acquaintance.

The manual is designed especially for use in those institutions where the laboratory facilities must be limited. The essentials of equipment for the use of the manual need not involve an outlay of more than two hundred dollars. Following an admirable introduction, which includes careful directions for procedure in experimentation, are twenty-five groups of experiments. These cover the field of sensation, motor activities, circulation changes, effects of practise, fatigue, memory, attention, and esthetic appreciation. Many suggestive supplementary questions are embodied in the various chapters.

The whole is a crystallization of years of successful laboratory experience, and the pedagogical strategy of selection, arrangement, form of statement, recapitulations, and the like, is deserving of most enthusiastic appreciation.

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*Hermann von Helmholtz.* LEO KOENIGSBERGER. Translated by Frances A. Welby, with a preface by Lord Kelvin. Oxford: The Clarendon Press. 1906. Pp. xviii + 440.

The Life of Hermann von Helmholtz, by Dr. Leo Koenigsberger, professor of mathematics at Heidelberg, published in three volumes by

Friedrich Vieweg und Sohn in 1902 and 1903, has been abridged and translated into English with correctness and tolerable literary skill by Lady Welby. In view of the large range of sciences covered by the work of Helmholtz and the fact that the original is in large measure an exposition of this work, the translator deserves much credit for the accuracy with which the terminology is used and the clearness with which the ideas are expressed. The translation is not perfect. For example, the first words of the volume—the title of Chapter I.—are in the German "Das Elternhaus von Hermann Helmholtz." The English version is "The Parentage of Hermann von Helmholtz." The "von" is incorrect, and, as a matter of fact, is not in the title as given in the table of contents. It may not be possible to translate "Elternhaus," but the word used lacks both force and accuracy. Or, to take a fairly typical sentence from the first page—the German text states that Helmholtz's father "wählte Philologie als Brotstudium, wenn er auch am liebsten seiner innersten Neigung folgend Philosoph geworden wäre." This is much weakened in the English: "He therefore chose the study of the classical languages as his profession, although his inclinations would have led him to prefer philosophy."

The translation is, however, satisfactory, and the abridgment is made as skillfully as could be expected. It would not perhaps be fair to ask that the index lacking in the original should have been added, though it is much needed, in spite of the analytical table of contents. Any work must of course suffer from an abridgment. The writer regrets that the original biography itself is not much fuller than it is, more especially in the direction of letters from Helmholtz, leaving room for a shorter and more readable biographical sketch for the general public. As an example of the drawbacks of an abridgment, there may be quoted the account of the death of Helmholtz's first wife, which in the English reads:

"Helmholtz's working capacity, however, became gradually exhausted, since the condition of his beloved wife was growing more and more serious; her relatives took charge of the family, and gave ceaseless attention to the invalid and care to her children. 'It was my privilege,' writes her sister, 'to be with her to the end. She died conscious, in simple strength as she had lived, fearless, with her friend beside her, ever turning towards the highest, on December 28, 1859.'

"Her husband wrote of her: 'I enjoyed the purest and highest happiness that marriage can give one; it was too beautiful for this world.'"

The last sentence is taken from a long letter addressed by Helmholtz to Dr. Binz, giving a detailed account of the last illness of his wife. The paragraph immediately preceding the one quoted is:

"Vom 24. Abends hob sich ihr Puls wieder, sie wurde wieder warm, bekam den Gebrauch ihrer Sinne wieder, nur war sie furchtbar matt und kurzathmig. Deshalb jammerte sie, das es noch nicht vorüber sei. Sie hatte noch ziemlich gute Nächte, liess sich vorlesen. Endlich am 28. früh, als sie sich eben wollte nach dem Sophea hinüberbringen lassen, trat ihr eine übermässige Menge von Sputis in die Luftröhre, und in weniger als 5 Minuten war sie erlöst."

The omitted parts give a more correct picture of Helmholtz's attitude and make less unexpected his remarriage within a year and a half.

While no special objection can be made to the way in which the abridgment has been executed, the writer must make serious complaint that the fact that we have to do with an abridgment is not stated on the title-page. At the bottom of page vi, under the author's preface, will be found the words "In the English edition the Life has been slightly abridged, with the permission of the author and German publishers." Most readers of the translation would not notice this foot-note, and none of them would understand from it that the three original volumes of 938 pages had been reduced to the 458 larger pages of the translation, the omissions amounting to about one third of the original text. Of the eight portraits and three pages of manuscript in the original, only three portraits are given in the translation, while no mention is made of the omissions. Lord Kelvin states in his preface: "The Oxford University Press has earned the gratitude of all English-speaking scientific workers in giving to them this English version of the very valuable and interesting Life of Helmholtz, by Dr. Königsberger." But surely the Oxford Press should print a new title-page, stating that the volume has been translated and *abridged* from the German work.

This notice is concerned with the translation only. It is not a review of Dr. Koenigsberger's book, and an attempt to appreciate Helmholtz's vast contributions to science would not be in place. A few words may, however, be added in regard to what Helmholtz accomplished for psychology and philosophy. As he tells us, his primary interest was always in mathematical physics; but he is one of the founders of modern psychology, and perhaps of modern philosophy. Lotze, Fechner, Wundt, and Helmholtz bear on their shoulders the structure of experimental psychology, and the share of Helmholtz is not the least. There would be less agreement as to his part in philosophy, but it is not small. Helmholtz and the school of Johannes Müller represent the rescue of philosophy by science from the vagaries into which German metaphysics had wandered, and whatever value may be placed on their actual contributions or on those of their successors—Mach, Boltzmann, Ostwald, Poincaré, and others—the writer believes that they, and Helmholtz most of all, have broken the way along which philosophy must advance.[1]

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[1] In a journal devoted largely to the exploitation and suppression of pragmatism, the following from a note on causation published in the biography as of the year 1855 may be quoted: "Hence we are induced by the strongest motives to *desire* its validity. It is the groundwork of all our thoughts and acts. Until we have it we can not test it; therefore we can but *believe* in it, *act* upon it, and find it justified by fair tests. We must anticipate the consequences; then the consequences will be its confirmation."

*Light Reactions in Lower Organisms.* I. *Stentor cæruleus.* S. O. MAST. *Journal of Experimental Zoology,* Vol. III., No. 3, 1906. Pp. 359–399. II. *Volvox.* S. O. MAST. *Journal of Comparative Neurology and Psychology,* Vol. XVII., No. 2, 1907. Pp. 99–180.

These two papers are characterized by the intensive, detailed methods employed by the author in his study of the reactions to light of two familiar lower organisms. Special attention and care were given to determining the direction and intensity of light falling upon the animals while they were in the experiments, in other words, to the regulation of the stimulus. The results with stentor are for the most part confirmatory, though obtained independently, of those obtained by Jennings upon the same organism. The light reactions of volvox had previously been considered in some detail by Holmes, with whose conclusions the present author takes a number of exceptions.

The observations upon stentor are divided under three main headings, viz., those upon moving stentors, upon attached stentors, and upon the threshold for light stimuli. The responses of stentor to light fall in line with the behavior of the protozoa in general, orientation and a course away from the light being brought about by motor reactions, which are repeated until the animal is in the position of least stimulation. This is attained when the anterior end is directed away from the source of light. The motor reaction is induced by an increase of illumination, whether this is caused by a change in the animal's position relative to the light, or by an actual increase in the intensity of the light itself.

Attached stentors do not orient to the direction of the light, largely because the tendency to maintain a position perpendicular to the surface to which they are attached overcomes the tendency to orient with reference to the light. Furthermore, the threshold for light stimuli is much higher in attached stentors. In free-swimming individuals the minimum threshold for animals stimulated by rays perpendicular to the longitudinal axis is 1.2 candle-meters, but in those stimulated by light striking the anterior end it is only 0.25 candle-meter. There is considerable variation in the threshold, the animals becoming readily acclimated to a given intensity.

The author's statement (p. 392) that "stentors once oriented remain oriented, if the light intensity is not too high, because they are least sensitive to light when the rays strike the posterior end," does not seem satisfactorily explained if we accept his conclusion that the motor reaction is the only means by which orientation is brought about and maintained. According to the motor-reaction precept, the light has no effective action until it has increased in intensity to the threshold increment, when a motor reaction is induced, which either places the organism again in orientation, or is repeated until that relation is attained. It is certainly not probable that stentor, once oriented and moving in a straight line from the light, can maintain that direction without some external directive force acting upon it to keep it oriented. If the motor reaction is not the factor which brings about this result, it would seem that there must be some other means by which stentor responds to changes in light intensity

less than the threshold which causes the motor reaction, so that when it begins to swerve from the proper alignment it is brought back again before it has gone so far that the motor reaction is induced. Will this part of the results have to be explained after all by something similar to the much despised "tropism theory"?

The first part of the paper on volvox is concerned with the structure and natural history of this interesting organism. Among other things the author states that "the eye-spots in volvox are located on the outer posterior surface of the individuals of which the colonies are composed, not on the outer anterior surface, as represented by Overton." A detailed and careful study of the method of locomotion and an analysis of the factors which bring about orientation are then made. Three of the sections in the author's summary embody the conclusions which are perhaps of most general interest. These are as follows (p. 178):

"The direction of motion in volvox is regulated by the relative light intensity on opposite sides of the colony, regardless of the ray direction."

"Orientation is not the result of 'trial and error' reactions as in stentor, euglena and other forms. Volvox colonies make no errors in this process."

"There is no evidence of motor reaction in a volvox colony, taken as a whole. Orientation is, however, brought about by motor reactions in the individuals which constitute the colony. If opposite sides of a colony are unequally illuminated, the individuals in the colony continually pass from regions of higher to regions of lower light intensity, and *vice versa*, as the organism rotates. This change in light intensity induces motor reactions in the individuals, which result in orientation of the colony. The motor reaction in positive specimens is induced only when the intensity to which the zooids are exposed is decreased, and in negative colonies only when it is increased."

We find, then, that the orientation of volvox is really a secondary result brought about by the independent reactions of the individuals of which it is composed. Although a definite result is obtained, the only coordination between the individuals is one due to the positional relation which they bear to one another and to the colony as a whole with respect to the light. This may, perhaps, be an additional reason for considering the volvox spherule a colony of individuals, and not an individual in itself.

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## JOURNALS AND NEW BOOKS

RIVISTA FILOSOFICA. January–February, 1907. *La funzione religiosa della filosofia* (pp. 3–35): P. MARTINETTI. – The function of philosophy is to promote through knowledge the supreme interests of life. Philosophy discards mythical elements. Philosophy, in its struggle with traditional faith, is not negative, but reconstructive. The positive result

of philosophic thought is the religious education of humanity. *Quid est veritas?* (pp. 36–56): B. VARISCO. – Pilate said to Jesus, "What is truth?" There are many who take the same skeptical attitude toward Christianity. A true metaphysics presupposes a final ethics, and *vice versa,* but the attempt to reach metaphysics through empirical ethics must be abandoned. Man can not help desiring happiness. Christianity aims at true happiness. *La Ginnastica dello spirito nella pedagogia del secolo XIX* (pp. 57–87): A. PIAZZI. – The individualistic hedonism of the eighteenth century has been replaced by ideals associated with the names of Herder, Herbart, and Pestalozzi. *Filosofia e filosofia del dritto* (pp. 88–106): A. PAGANO. – The revival of philosophy of right rescues that study from a long period of depression which had its origin in prevailing philosophical opinions hostile to the presuppositions of the philosophy of right. So objective a theory can not be reconciled with subjective metaphysics. *Rassegna bibliografica* (pp. 107–127). *Giosuè Carducci—In memoria di C. Cantoni—Sull'ordinamento degli studi filosofici universitari* (pp. 128–136). *Sommari delle riviste straniere. Libri ricevuti.*

RIVISTA FILOSOFICA. March–April, 1907. *Dalla critica alla metafisica* (pp. 145–164): A. CHIAPPELLI. – The starting-point of critical philosophy is the relativity of the object of knowledge to the mind. The spirit transcends its limitations in perceiving them. Determinism in science has to be reconciled with spontaneity in ethics and esthetics by the discovery of a higher principle, presumably spirit. *La morale di Tertulliano nei suoi rapporti colla filosofia stoica* (pp. 165–183): G. BONFIGLIOLI. – Tertullian was by temperament of the extreme stoic type. There is a striking parallelism between his opinions on ethics and those of the stoics, due to his faith in a concept of nature and in the maxim "live according to nature." *Le premesse dell'umanismo* (pp. 184–200): G. DELLA VALLE. – Humanism is the psychological interpretation of criticism, the point of union between empiricism and rationalism. Epistemological humanism is born of the effort to overcome the dualism of form and content. Individualism in science and ethics raises the problem of the relation of the individual to society. *Dualismo biologico e limiti della responsabilità penale* (pp. 201–224): R. MONTUORI. With regard to criminal responsibility two theories have been held; the classical one, which emphasized free will and declared punishment the rendering of justice because deserved, and the relatively biological one, skeptical of free will. Primitive vital activity shows two opposed forms, reflex and inhibitive. Reflex acts are for defense. This purpose is a test for reflex activity. The will has its origin primarily in the faculty of arrest. (To be continued.) *Rassegna bibliografica. Opere di:* B. Labanca, A. Meinong, Gustave Belot, Th. Ribot, D. Draghicesco, Guiseppe Prezzolini (pp. 225–251). *Bollettino bibliografico. Opere di:* Giordano Bruno, Camille Hèmon, E. Buonaiuti, Sully Prudhomme, George Dumas, A. Schopenhauer, F. Delvolve (pp. 252–258). *Articoli di riviste straniere. Notizie e pubblicazioni. Voci di lettori. Sommari delle riviste straniere. Libri ricevuti.*

REVUE PHILOSOPHIQUE. November, 1907. *Doit-on fonder la science morale et comment?* (pp. 449–475): A. FOUILLÉE. – An extract from the introduction to the author's "Morale des idées-forces," which has just appeared. Ethics is a genuine science, having its basis in logical, psychological, and epistemological principles of which the leading idea is that of the "idées-forces." *Le rôle civilisateur des abstractions: du totémisme au socialisme* (pp. 476–494): E. DE ROBERTY. – Abstractions are necessary to scientific progress. The abstractions and generalizations of totemism were to primitive society what those of socialism are to modern society, therefore socialism may be called modern totemism. *L'énergétique et le méchanisme au point de vue des conditions de la connaisance* (pp. 495–517): A. REY. – Both energism and mechanism may be possible scientific methods, but the former is limited to mere non-hypothetical description, while the latter anticipates our possible experiences, and is, therefore, more suited to advance physics. Energism is a useful auxiliary procedure, but always subordinate to mechanism. *De la "plasticité" dans l'association de idées* (pp. 518–538): DROMARD. – A classification of the various degrees of plasticity which the association of mental images presents in characteristic forms of normal and pathological activity. *Revues critiques:* (Morton Prince, Oosterreich, C. Sabatier) *La dissolution de la personalité:* S. JANKELEVITCH. (Orestano, Trojano) *Le concept de valeur d'après deux ouvrages récents:* J. SEGOND. *Analyses et comptes rendus:* F. Evillin, *La raison pure et les antinomies:* L. DAURIAC.

Busse, Ludwig. *Die Weltanschauungen der grossen Philosophen der Neuzeit.* Dritte Auflage. Leipzig: B. G. Teubner. 1907. Pp. 164. 1 M.

Cesca, Giovanni. *La filosofia dell'azione.* Milan: Remo Sandron. 1907. Pp. 330. 4 l.

Cohn, Jonas. *Führende Denker.* Leipzig: B. G. Teubner. 1907. Pp. 117. 1 M.

Flügel,.O. *Herbarts Lehren und Leben.* Leipzig: B. G. Teubner. 1907. Pp. 156. 1 M.

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## NOTES AND NEWS

WE take the two following notes from *Nature* for November 7: "The Huxley memorial medal of the Royal Anthropological Institute was presented to Professor E. B. Tylor, F.R.S., on Tuesday, November 5, in recognition of his distinguished services to anthropology. On October 2 Professor Tylor celebrated his seventy-fifth birthday, and the anniversary was made the occasion of the presentation to him of a volume of essays representative of British anthropology. The current volume of the *Journal of the Royal Anthropological Institute* is dedicated to Professor Tylor; and the presentation of the Huxley memorial medal is another mark of the esteem in which he is held by anthropologists."

"No one more fully understands the danger of indiscriminately using a questionnaire than Dr. J. G. Frazer, who in publishing through the Cambridge University Press his 'Questions on the Customs, Beliefs, and Languages of Savages' is careful to point out the true method of utilizing them. They are intended, not so much to be put directly to the savage, as to indicate to the inquirer in the field those subjects upon which students at home desire information. Leading questions should be avoided, as they tempt the savage to give answers which he thinks will be acceptable. The savage should be encouraged to talk in his usual vague way on the subject under investigation until he has exhausted his information for the time, when a question judiciously asked may jog his memory. Unexpected information casually offered is the most valuable of all, 'first, because not being foreseen by the civilized man it can not have been consciously or unconsciously suggested by him to the savage; second, because it may put an entirely fresh complexion on a whole series of customs and beliefs about which we had fancied that we knew all that was worth knowing.' If used with this much needed caution, this suggestive collection, which is supplementary to the manual issued by the Royal Anthropological Institute, will be of much value to travelers with a taste for investigating the manners and customs of savage or semi-savage races."

THE *Nation* for December 5 writes as follows regarding the present movement in Germany toward some measure of cooperation, in church work and in scientific research, between Catholic and Protestant theologians: "The efforts on the part of prominent Protestant theologians of Germany to come to some kind of understanding with the more independent representatives of Catholic scholarship in the interests of common scientific research and practical church work, are producing a literature of their own. The well-known university address of Professor Adolf Harnack, delivered in Berlin on the last anniversary of the Kaiser's birthday, had this for its theme, and attracted wide attention. Now Professor Tschackert, of the University of Göttingen, has just published a work of one hundred and forty-three pages (Munich: C. H. Beck), entitled 'Modus Vivendi: Grundlinien für das Zusammenleben der Konfessionen im deutschen Reich,' in which he outlines a plan showing why and how the Catholic and the Protestant churches, without in any way sacrificing any fundamental principles, could yet cooperate in most of the departments of church work, such as charity, missions, social problems, and the like. Tschackert is, however, convinced that such an understanding can not be reached with the extremists in either camp."

THE Board of Anthropological Studies at the University of Cambridge recommends the establishment of a diploma in anthropology similar to the one offered at Oxford. The work of three terms, not necessarily consecutive, is to be required from candidates.

PROFESSOR J. G. FRAZER will fill the chair of anthropology recently founded at Liverpool.

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